Commentary

Dr Schoof and coauthors are to be complimented on their continuing efforts to unravel the complex adaptive response that occurs when the pulmonary artery and its contained valve are placed in the systemic circulation. This work has significant interest to all cardiac surgeons and cardiologists involved in the care and management of patients who have had surgical procedures that use the pulmonary artery and valve as the systemic output for the heart. Such procedures include the Ross, arterial switch, Damus-Kaye-Stansel, and Norwood procedures. All of these have been associated with episodes of failure of the valved conduit, usually related to progressive dilatation, loss of adequate leaflet coaptation, and central neoaortic valve regurgitation. Dr Schoof has used the growing pig as an experimental model of the Ross operation and has provided valuable insight into the growth characteristics associated with translocation of the pulmonary artery and its contained valve into the systemic circulation. Dilatation of this structure is evident, particularly at the point of distention, when the aortic crossclamp is removed and the autograft valve and conduit are subjected to systemic pressures and modulation or remodeling of the valve cusps and of the pulmonary artery. The authors have previously shown significant increase in valve cuspal weight, valve cuspal height, and valve cuspal width after a Ross operation. They have shown an increase in the circumference of the pulmonary autograft wall over a 10-month period in the growing pig, as well as an increase in thickness and volume. These changes in dimensions closely match what one would anticipate in terms of demonstrated clinical performance of the pulmonary autograft when it is used as a root replacement in patients. In the present study, the authors have provided a morphometric analysis of the histology and immunohistochemistry of the autograft root in a growing pig model. They have demonstrated that the adaptive response of the pulmonary autograft is not one of adaptation toward a typical aortic medial pattern but one that retains the basic morphology of the pulmonary root. They found the autograft wall to be viable, revascularized, and without degenerative phenomena. Enlargement and rearrangement of smooth muscle cells and an increase in collagen III were identified.

The recent studies are extremely important and helpful to physicians concerned about the fate of patients requiring use of the pulmonary artery in its contained valve for systemic ventricular outflow. However, the authors raise many unanswered questions that are open for further study and detailed analysis. The authors' data are primarily limited to the pulmonary autograft at the autograft aortic transition area and circumferential segments of the autograft, probably all distal to the sinotubular junction of the autograft. The fate of the autograft sinuses, the thinnest segment of the pulmonary root, is unclear.

These studies, along with other clinical information, suggest that one should not anticipate that the autograft root will behave like an aortic root when transplanted

to the aortic position. Comparison of the autograft root in terms of dimensional changes to normal standards for aortic roots is inappropriate. The absence of degeneration within the autograft root in this rapidly growing model is particularly important and provides very useful information to the clinician. The absence of significant evidence of valvular insufficiency is of particular interest. However, this was not studied in any detailed fashion. Clinical data would suggest that pulmonary autograft insufficiency is primarily related to dilatation of the aortic anulus and/or dilatation of the sinotubular junction. As proper surgical management can reduce the likelihood of these complications, the potential of reducing the incidence of late autograft valve insufficiency is certainly available. This excellent manuscript opens the door and invites additional research to quantitate the adaptive response of the pulmonary artery and its contained valve to systemic pressure loads.

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